THE MODEL ENGINEER

Vol. 97 No. 2417
THURS SEPT 18 1947 9d.

The MODEL ENGINEER

PERCIVAL MARSHALL & CO. LTD., 23, GREAT QUEEN ST., LONDON, W.C.2

18TH SEPTEMBER 1947 VOL. 97. NO. 2417

SMOKE RINGS

Our Cover Picture

● THIS SHOWS Engine No. 3809, one of the huge dual-purpose articulated engines of the Atcheson Topeka & Santa Fe R.R. pulling out of Tucumcari, New Mexico, to the West, with an " extra " passenger train. These massive machines are practically the largest and most powerful locomotives on the Santa Fe R.R. and are employed chiefly in New Mexico, which is typical Santa Fe territory.

The Grand Regatta

● THE GRAND REGATTA at Victoria Park, which, according to long established custom, took place on the Sunday immediately following the " M.E. " Exhibition was an outstanding success. Representatives from power boat clubs in all parts of the county made the journey, and saw the largest collection of boats, both old and new, which has ever been gathered together on this well-known water of the Victoria Club. Starting at 11 o'clock the day's programme was barely completed when the setting sun called a halt. Mr. Gems Suzor from Paris received a spontaneous welcome from everybody, and more fortunate in his running than last year, he astonished the crowd with a fine performance of just over 40 m.p.h. with his latest boat powered with a 10-c.c. engine, which left the 30-c.c boats well behind. A lovely day, an enormous crowd, and a continuous spectacle of splendid boats afloat, made this year's Grand Regatta the high spot of the model marine world. A fuller report will appear shortly.

A Great Sailor Passes

● ALL LOVERS of deep-sea sailing ships—and a considerable proportion of them are ship modellers, as is shown by the number of square-rigged ship models to be seen year after year at THE MODEL ENGINEER Exhibition—will regret to hear of the death of Gustaf Erikson, the very last owner of a great fleet of sailing ships. Born over seventy years ago, of sea-faring parents, he went to sea at the age of nine on the North Sea timber barques. He had an inbred love of the sea and ships, so worked his way up, being by turns cabin-boy, deck-hand, cook, and able seaman. At the age of 19, he was appointed to his first command. After two years in command of Baltic traders, he decided he needed a wider experience, so he went deep sea and sailed around the world as mate in various Finnish barques. By 1902 he was again in command and continued at sea until 1913, when he set up in business as an owner. Sailing ships were his first love and he bought nothing else. After the first world war, when the few remaining sailing ships were being sold at scrap prices, he bought quite a number of them. One of his bargains was the beautiful *Herzogin Cecilie*, which he obtained for £4,000. By strict economy and careful planning, he made his

sailing ships pay. He ran them with youthful masters and men, many of them only too keen to work for next to no wages to get experience in sail. He could not afford to insure his ships, the rates for sailing ships being so high. Instead, he did his own surveying, and attended personally to the smallest details; and the results justified his policy. When he bought a British ship he invariably restored her to her original name, to the great satisfaction of British shiplovers. When any of his ships was lost he salvaged as much as possible, especially masts, spars, sails, deck-houses and fittings and stored them at Mariehamm as spares to be used if required for his remaining ships. One of his latest purchases was the lovely *Moshulu*, one of the largest and finest of the later four-mast barques. Many of the present generation would never have seen a square-rigged sailing ship had it not been for Capt. Erikson, whose love and enthusiasm kept so many of them on the seas long after the economic conditions of modern life would have scrapped them. He has earned our respect and gratitude.

Another Passenger Track

● ANOTHER ADDITION to the many passenger-carrying club tracks now in operation has been made by the Society attached to the works of the Automatic Telephone and Electric Co. Ltd., of Liverpool. This is laid in gauges of $2\frac{1}{2}$ in. and $3\frac{1}{2}$ in., and will be officially opened at 2 p.m. on Saturday, September 20th, in the main works canteen of the Company at Edge Lane. The ceremony will be performed by Mr. R. O. Harper, Chairman of the Northern Association of Model Engineers, and neighbouring societies are invited to attend, with their locomotives. It is hoped to carry out some trials on this occasion, and I am asked to mention that refreshments will be available.

A South Wales Development

● THE ACTIVITIES of the Port Talbot Society are being expanded to include membership from the Afan Valleys, Neath, The Vale of Neath, Briton Ferry, and Skewen. Attendance at recent meetings has been very promising, and an influx of new members from the districts mentioned is confidently expected. A temporary meeting room has been provided by Mr. W. S. Williams, who has also kindly promised space for 100 ft. of passenger carrying track. Mr. Williams will be pleased to hear from any prospective members at Hazledene, Pentyle, Aberavon.

Invalids at the Show

● ONE OF the most pleasing incidents at the Exhibition was the visit of a group of disabled service men from Roehampton, who came in their invalid chairs and patiently wheeled their way round the show. They were immensely interested, and as model makers and craftsmen themselves they expressed high appreciation of the work on view. Our staff took special pains to enable them to get a close-up view of the outstanding models, and I am quite sure they returned with fresh encouragement to master their physical misfortunes. So, once again, model engineering adds a little happiness to life.

The Roehampton boys enjoying a close-up view of the circular track

Good Wishes from S. Africa

● AN ENVELOPE decorated with an imposing array of South African stamps reached me at Exhibition time from Mr. C. E. Till of Jahannesburg. It contained this inspiriting message from a group of friends of the "M.E." in that city:—

Dear Mr. Marshall,—Greetings! Success! Good luck! May the Exhibition be the best ever, is the wish of the Boys south of latitude O. We (immigrants, old stagers, gents, ladies, publicans and politicians) will be thinking about you, drink your health, and (above all) carry on the glorious work of miniature engineering. Yours eternally, I., O.S., G., L., P. & P. (To be continued next year.) Thank you, Jo'burg your good wishes are cordially reciprocated.

Brighton Begins its Season

● I HEAR from Mr. F. P. Blackford that the Brighton Society is resuming its indoor meetings on Friday, September 26th. I had a pleasant chat with Mr. Blackford at the Exhibition and was glad to hear that enthusiasm runs high in Brighton and a really successful season is in prospect. He will be pleased to hear from new members at 68, Shaftesbury Road, Brighton.

A Club for Motherwell

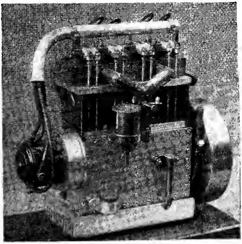
● A NEW club for the Motherwell district has made a good beginning with an attendance of forty prospective members at its inaugural meeting. The meetings are to be held at the Y.M.C.A. centre in Motherwell, and full information as to dates and times may be obtained from Mr. J. Glassford, 52, Etna Street, Wishaw.

Percival Marshall

I.C. ENGINES AT THE EXHIBITION

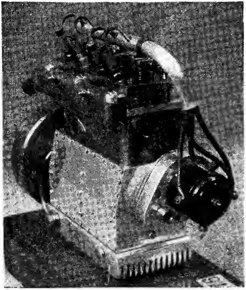
by Edgar T. Westbury

FOR the first time in the history of the Exhibition, internal combustion engines have been demonstrated in action, on the Grand Circular Track, where their success in propelling model cars, boats and aircraft has impressed many people, including not a few who have had a good deal of experience with models equipped with other forms of motive power. In the model aircraft, the restrictions of space made it necessary to keep down the size of the machines, and the engines being in proportion, the compression-ignition type of engine was predominant both in the S.M.A.E. and trade demonstrations. So far as can be ascertained, the engines used were all commercially-produced, and the last vestiges of doubt as to their reliability and efficiency were removed by the easy starting and consistent performance of these engines throughout the period of the Exhibition. At least one petrol-engined plane was shown in action, however, and gave an excellent account of itself.



The 4-cylinder o.h.v. engine by E. H. Newell

In model racing cars, the petrol engine is, as yet, still holding its own, and nearly all the cars run by the Pioneer Model Racing Car Club were fitted with petrol engines of 5- and 10-c.c., many of them being veterans which have been described or referred to in THE MODEL ENGINEER or *The Model Car News*. The engines of these are in most cases home-constructed. Cars driven both by petrol and compression-ignition engines were featured in the trade demonstrations of model racing cars.



End view of Mr. Newell's engine

Power Boat Engines

A wide variety of engines was seen in the model power boats, ranging from the 30-c.c. engines of the large tugs and launches, down to the 0.3-c.c. C.I. engine in the hydroplane demonstrated by Mr. Sherwood, which was surely one of the tiniest boats ever to run with this form of motive power.

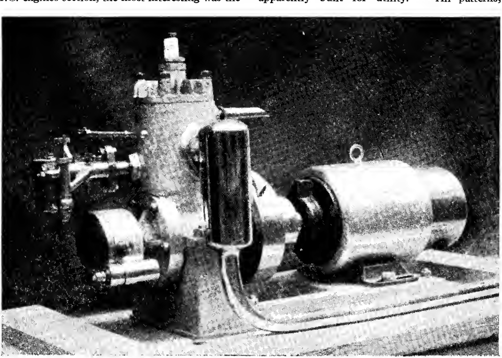
All kinds of power plants—petrol, compression-ignition, steam and electric, were represented in the boats demonstrated. Nearly all the engines were amateur-built, and differed widely in design. The common impression that petrol engines are temperamental and difficult to start was not borne out by the behaviour of these engines, which started up promptly and gave very little trouble in running. They were, of course, running at reduced power, in view of the restricted space in the tank, and, therefore, temperament did not show up to the extent that it would in racing on open water, with all adjustments at concert pitch. Neither was there much to complain about in respect of noise, except in one or two cases, where both steam and I.C. engines occasioned equal criticism in this respect.

Competition Models

Apart from the interest centred around the running track, however, I.C. engines were much less prominent than they have been at some previous MODEL ENGINEER Exhibitions, and from some aspects, were a little disappointing. Of the only two models entered actually in the I.C. engines section, the most interesting was the four-cylinder o.h.v. engine by Mr. E. H. Newell, of Havant (No. 176). This is an excellent example of fabricated construction embodying a crankcase built up mainly from sheet aluminium alloy, with detachable oil sump equipped with fins on the underside, and a cast-iron cylinder block with detachable head. The valves are disposed vertically in the head, and operated by straight rockers and push rods from a side camshaft. Separate manifolds for inlet and exhaust are fitted on opposite sides of the engine, and the carburettor has float feed and throttle control. Lubrication is by an internal oil pump, and a high-tension ignition distributor is driven from the end of the camshaft. The workmanship and finish of this engine are of a very high order.

A "Lightweight"

The other engine in this class, a 30-c.c. stationary two-stroke, by W. N. Thatcher, of Abingdon (No. 177), resembles the early Stuart-Turner "Lightweight" engine in its general design, having a water-cooled cylinder with an inserted liner, and a finned head. It is shown direct-coupled to an electrical generator which is stated to have an output of 99 watts, a fairly useful performance for an engine of this size. An enclosed contact-breaker is fitted to the engine, and a carburettor of the "Atom" R type, which is a very interesting example in fabricated construction. The highly polished plated silencer strikes a rather harsh and incongruous note, otherwise the plant is quite a workmanlike job, apparently built for utility. All patterns, including that of the bedplate, were made by the competitor, and were shown with the exhibit.



A 30 c.c. two-stroke engine and dynamo, by W. N. Thatcher

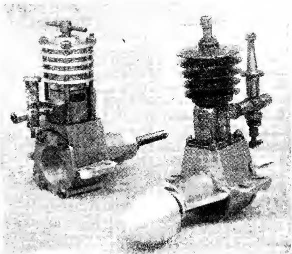
The Austin Chassis

Among the mechanically-propelled road vehicles the model of an Austin 12 chassis, by G. C. S. Seymour, of Southwick (No. 186), deserves special mention, because, quite apart from its general merit as a complete model, it contained a working four-cylinder petrol engine of original design, embodying many original and unusual features. The valves of this engine are horizontally disposed, and operated by bell crank levers through vertical push rods, from camshafts on each side of the engine. Internal passages serve as manifolds for inlet and exhaust. An ignition distributor is fitted to the front end of one camshaft, and the sparking plugs are vertically disposed in the centre of the cylinder head. The carburettor has a scale-size float chamber, and full working controls, both by hand lever and foot accelerator. A scale working model radiator, with belt driven fan and circulating pump, is provided. Apart from the engine, everything else on the chassis is modelled

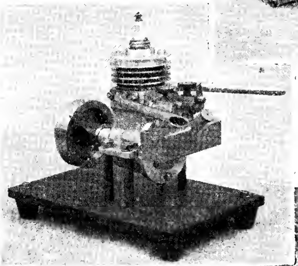
to exact scale, including the braking system transmission and differential gearing, and even the grease-gun nipples.

Two of the model racing cars shown in the competition section have commercially-made engines fitted, but the third, a model of the Mercedes-Benz, 1937, Grand Prix racing car, by F. E. Backshell, of East Sheen (No. 193), is equipped with an engine built by the constructor, on the lines of the Curwen 5-c.c. racing car engine, as originally built, with twin port-controlled carburettors.

Although quite a number of aircraft in the competition section were equipped with petrol and C.I.



Two miniature compression-ignition engines by C.K. Grover and G. A. Watts

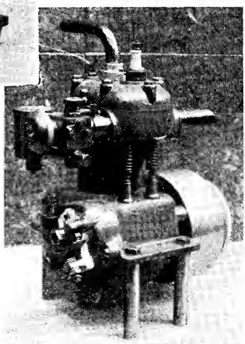


A 5 c.c. Curwen type two-stroke, exhibited on the S.M.E.E. stand

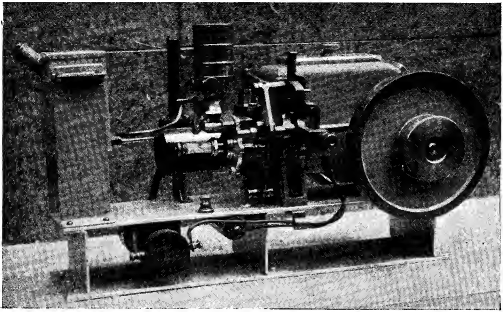
engines, only one of these, so far as could be ascertained, was built by the constructor of the aircraft. Some of the model power boats in the competition section appeared somewhat inadequately powered with tiny C.I. engines, but in those equipped with home-made engines, the error was, if anything, in the other direction. In one case, a 30-c.c. air-cooled engine had been installed in a horizontal position, with a complex and rather cramped arrangement of transmission gearing to the propeller. The displacement cruiser *Atomic II*, by L. V. See, of Portsmouth, had a large-capacity water-cooled two-stroke which was only just adequately housed in the available space, but judging from the care taken in the detail work in this power plant, as in the hull fittings, it appeared to be a practical and workmanlike job.

Don't Seal the Hull

Some model power boat constructors seem to make a point of hermetically sealing the hull, and making inspection of the power plant and internal fittings difficult or impossible; this is a great mistake in a model entered for competition as a working model, as it is quite clear that the judges are not likely to award high points for the parts they cannot see. In the Junior Section, only two examples of



Hallam 30 *c.c. side-valve engine by N. H. Toomby*

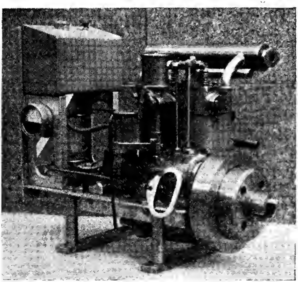


A 15 c.c. Aveling road roller engine, fitted for stationary running, by N. H. Toomby

I.C. engines were shown, both being compression-ignition engines of 2-c.c., by C. K. Grover, of Gravesend (No. 264), and G. A. Watts, of Northampton (No. 275) respectively. These were quite praiseworthy efforts and may perhaps be regarded as an indication of modern tendencies in the rising generation of model engineers ; but the mechanical simplicity and somewhat stark exterior appearance of these engines are rather against their success as exhibition models, however successfully they may work. There is, however, plenty of scope for a more imaginative approach to the design of these engines.

On the S.M.-E.E. stand, two very interesting petrol engines were shown, namely, the 30-c.c. two-stroke in Mr. Weaver's model speedboat *Fleche d'Or*, which has already been illustrated in THE MODEL ENGINEER, and a 5-c.c. engine based on Mr. Curwen's model car engine.

Although exhibited on a trade stand, the three models by Mr. N. H. Toomby, namely, a Hallam 30-c.c. side-valve engine, a 15-c.c. MODEL ENGINEER road roller engine, and a 30-c.c. twin "1831" engine, may be classed among amateur work, as they are not connected directly with the products of the firm concerned, Messrs. Delapena & Son Ltd., who were demonstrating honing machines and appliances. The workmanship and finish on these three engines are very good, and they are displayed effectively, the latter two being mounted on stands with tanks and ignition equipment, ready for running.



"1831" *twin-cylinder 30 c.c. engine and starter, by N. H. Toomby*

(*To be continued*)

*Ship Models at "The Show"

by "Jason"

WELL, that hull of the *Norman Court*, now rigged, is this year's winner of the *Sailing Ship Championship Cup*. My own opinion is that this is one of the best sailing ship models of the last dozen exhibitions. The maker of the model is Mr. John F. Alderson, of Pontypool, Mon., and formerly of the *Ilford Ship Model* *Society* one of whose members won the *Steamer Championship Cup* in 1938 (R. A. Chapman's *Sworddance*). It is more than eleven years since Mr. Alderson started on his model. When I met him he assured me he had never attempted to rush his model. Well, twelve years (with six off for war purposes) is not rushing it. His jackstays on his yards are scale jackstays and the jackstay-dogs are scale too. Many modellers fall on the jackstays, and of those who remain, very few indeed can finish the course in the dogs being to scale. This is one of my first and quick tests in looking at a windjammer or clipper model. The prototype *Norman Court* had clinker-built boats. *The Champion has built his boats up plank by plank.* They are lashed upside-down on the house or boat-skids and just in case anyone should look underneath into the boats he had fitted and equipped them. The Alderson blocks are to scale, which is a weak point in the majority of models. It may be that his fish tackle blocks were on the small size. They were almost the same size as the lower topsail sheets. My guide to the size of these blocks is the cat-head sheaves. As the *Norman Court* was nearly a quarter century before my time, I would not like to be dogmatic. Sailors also have a saying, "Different ships, different longsplices." One quarrel I have ; there seemed to be a large number of spare spars, but perhaps shipowners were more generous in those days. The clippers, however, when "cracking on," could easily snap off a to'gal'n'-mast or two.

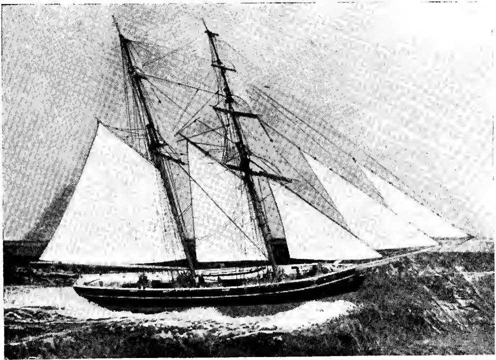


Photo by] [*M. B. Craine*

The model of "Nymph," an opium clipper, by F. W. Shipsides of Bristol well deserved the silver medal

Norman Court's anchors were the best I've seen for a long time. There's one minor point. I do not feel like accepting that the *Norman*

**Continued from page* 290, "*M.E.*," *September* 11, 1947.

Court sailors led their braces *under* the pin instead of *over* the pin. It may be that the maker has proof of this, but Blake, Rodney, Nelson, Franklyn, Jellicoe and Tovey are on my side. Most other gear in the ship is under the pins, but not the topsail and course braces. It will be obvious that I have the greatest difficulty criticising the Champion Sailing Ship, and what remains is to congratulate most heartily Mr. Alderson on his

Silver Medals—

- L. V. Lee (Portsmouth), free-lance design displacement express cruiser *Atomic II*, 18 knots (actual).
- E. N. Taylor (Gosport, Hants), W. L. Wilson Line s.s. *Livorno*, cargo ship, 25 ft. to 1 in.
- And V.H.C. for excellence in work, I. W. Marsh (Barry Dock, S. Wales), clipper *Sir Lancelot*, $\frac{1}{8}$ in. to 1 ft.

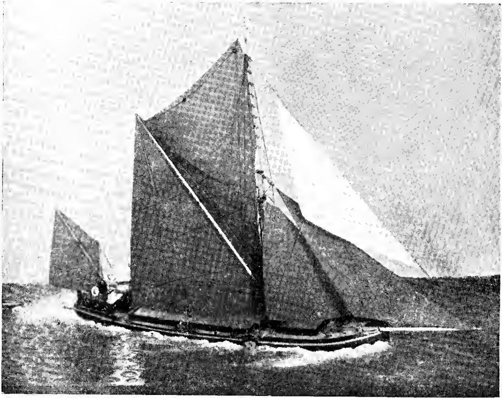


Photo by] [*M. B. Craine*

A model Thames Sailing Barge by Mrs. Iris McNarry of Barton-on-Sea, Hants, to a scale of 1 in. to 14 ft. Awarded a bronze medal. A fine job, well rigged, in a good setting

success. If you who are reading this happens to be young, then have a go yourself!

Before I go any further, here is a list of cup and medal winners, together with a list of diploma awards, as decided by the judges up to Saturday evening, August 23rd, 1947. There will be very few, if any, further awards in the Marine Section. This list does not include Junior awards, nor any of the ship models included in Class 16 (i.e. Ingenious Utility). I will be dealing with those ship models later.

CHAMPION SAILING SHIP—J. F. Alderson (Pontypool), *Norman Court*, 3-masted ship, $\frac{1}{8}$ in. scale.

CHAMPION STEAMER—D. McNarry (Barton-on-Sea), *Stirling Castle*, Union Castle liner, 50 ft. to 1 in.

- W. H. Honey (Tulse Hill, London), scenic miniature barque *Lalla Rookh*, 100 ft. to 1 in.
- K. P. Lewis (Birkenhead, Cheshire) C.P.R. liner *Empress of Australia*, on their Majesties' visit to Canada, 75 ft. to 1 in.
- F. W. Shipsides (Portishead), opium clipper *Nymph*, $\frac{1}{16}$ in. to 1 ft.

Bronze Medals—

- Wing Comdr. J. F. Lewis (Craven Arms), Air Sea Rescue Launch (working power boat), $\frac{1}{2}$ in. to 1 ft.
- A. Greenwood (Romford), A.S.R. Launch (in construction), $\frac{1}{2}$ in. to 1 ft.
- L. Glass (Bristol), *Elizabeth Jonas* (1580).
- G. Miller (Southgate, N.14), full hull *Cutty Sark*, $\frac{1}{8}$ in. to 1 ft.
- D. S. Drury (Sheffield), scenic model, *Coral Seas*, 100 ft. to 1 in.

Photo by] [*M. B. Craine*

Wing-Commander J. F. Lewis (Craven Arms) secured a Bronze Medal for his A.S.R. Launch—a working model

G. F. Campbell (Streatham), tug *Wrestler*, $\frac{1}{2}$ in. to 1 ft.

Iris McNarry (Barton-on-Sea, Hants), Thames sailing barge, 14 ft. to 1 in.

The following were awarded Diplomas: G. M. Baillie (Shanklin), R. G. Bosberry (Fareham), R. V. Shelton (Dunstable), D. S. Anthes (Sheffield), E. Kilner Berry (Worthing), M. C. Lawrence (London, S.W.18), A. M. Welter (Northampton), H. C. Anstead (Weybridge), H. Fitterer (Dalston, E.8), A. R. Garland (Surbiton), M. E. Moon (Holloway), C. Ellis (a schoolboy, Radley School), H. A. Eriksen (Muswell Hill), A. J. Coote (Bristol), W. R. Finch (Potter's Bar), H. A. Kirby (Mitcham), V. O. Lawson (Wandsworth Common), C. Money (Sheffield), A. W. Washbourn (Eastleigh), L. A. Willott (Luton), and D. C. Wray (Edgware).

I think I have just enough space left to deal with the *Cutty Sark*, a full hull model by G. Miller, of Southgate, N.14. He won a Bronze Medal with this model, a piece of work which was his first attempt at modelling. His work contains plenty of errors due to lack of experience mainly, but he tackled an exceedingly difficult job *and carried it through.* He came to the Exhibition fully prepared to have his work "chewed over." Most of the other models had mistakes, errors, lapses and even *faux pas.* If, then, I criticise Mr. Miller's work, it is really using his model for

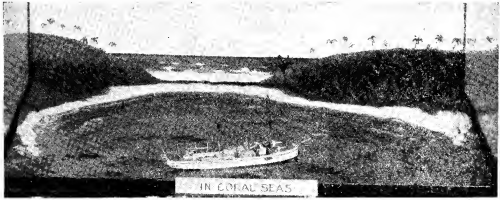


Photo by] [*M. B. Craine*

"Coral Seas" by D. S. Drury of Sheffield won ***a Bronze Medal*** *for his artistic setting. A model of H.M.S Magpie"* (1889) ***is shown in the foreground***

demonstration purposes. There has grown up a generation of ship modellers who knew not *Ships and Ship Models*, who had never read (and digested) the annual criticism of the Exhibition models. My criticism is always well meant, never ascetic or vitriolic. Very often, however, I do hit hard.

enamel mixtures for domestic purposes, BUT your model is at least craftsmanship, even if not art. Consider a royal yard on a clipper ship. You are working to a scale of $\frac{1}{8}$ in to 1 ft. The yard is just 12 in. diameter at the quarters, we'll say. Your yard, then, on the model has to be $\frac{1}{8}$ in. diameter. You take great care indeed. You've

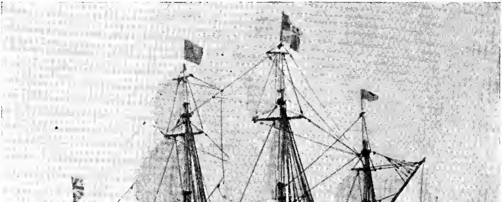


Photo by] [*M. B. Craine*

In a year when miniatures have triumphed, here is the "Prince" by Charles Hampshire, a model about $1\frac{1}{2}$ in. long on loan from his collection of over 40 models, all to a scale of 1/64 in. to 1 ft. Mr. Hampshire has done much to elevate the standard of miniature work

Well! here goes. This year the finish shows signs of deterioration—badly. Several of the models looked as if they had been painted with a sash tool. Why spend a couple of years on a model and then paint it as an amateur house-painter would do. *When*, I repeat in much larger letters, WHEN do you paint your model? I have not had a chance of meeting all the modellers, but Mr. Miller pleaded guilty to "giving it a coat or two when he had made the model." Make a note, then, that lower masts should be painted and rubbed and painted long before setting up the rigging. Remember my remarks about the ladders and handrails on McNarry's *Stirling Castle*. The handrails (white) and ladders (teak), if added to the model in a finished condition, will certainly look better than if you had painted them after placing. Then there's the paint itself. The popular stores sell all sorts of nice varnish or

bought lancewood—well you *intended* to buy lancewood, but couldn't find any. Still, the old broken fishing rod turned out to be best quality lancewood—you've turned out a great job. I'm assuming you to be a careful sort of worker. You put two coats of white paint, nice enamel, shall we say, given a thickness of 1/64 in., and there are two sides to the yard, the diameter is now increased to 5/32 in Mark well, this is with careful work Along comes a judge: "Upper yards look too heavy!" Now you can understand why a 6-in. diameter signal yard became 5 ft. thick on a small model in an inexperienced worker's hands. Cheap paint and painting on the model. I've already asked the question *when* do you paint? I should also ask where do you buy your paints? Sorry, but I must end now. Even *Jason* must toe the line in the Editorial Room. I'll write about paint and finish, later.

TEMPERATURE MEASUREMENT

by "Arty"

IN the latter portion of "Jet Propulsion," which appeared recently in THE MODEL ENGINEER, the question of temperature measurement was not considered. While these are usually required in test work, it is customary to rely on proprietory articles to obtain them and it is not usual to have amateur produced temperature measuring devices. Not many people, for instance, would attempt to make one of the simplest and most common items, a mercury-in-glass thermometer (although actually they are fairly easy once the knack is mastered). However, a knowledge of the methods of temperature measurement and their limitations and advantages may be useful to anyone indulging in test work as well as being complementary to the "Jet Propulsion" article, and so some of the relevant points will be outlined here.

When determining which type of thermometer would be best suited to the application, several considerations should be borne in mind :—

(*a*) Range of temperature required?

(*b*) Convenience. The indicator may be attached to the testing body, either necessitating the observer being very close or else it may be possible to take the readings from some distance, or the indicator may be placed remote from the test body. Will the instrument be subjected to shock, vibration, etc.? How easy is it to make an observation? Is the scale open? Is it necessary to record the values continuously?

(*c*) Can a time lag between change in temperature and change in indication be tolerated and, if so, how much?

(*d*) How many readings are required? Are several required in quick succession from one test point or from several test points simultaneously?

(*e*) How will the test body assume the temperature of the hot body (the term body includes liquids and gases)? Will the insertion of the test body affect the temperature of the hot body appreciably?

(*f*) Will the test body set up undesirable physical or chemical effects?

In general, some of the criteria for accuracy from temperature measuring instruments are :—

(*a*) The contact must be satisfactory, that is, there must be no appreciable temperature difference between the test and the hot body.

(*b*) No chemical reaction to liberate or absorb heat.

(*c*) No condensation may be allowed as the latent heat of condensation or wet bulb effect will cause errors.

(*d*) Small heat capacity of test body so as not to disturb the temperature conditions of the hot body and to follow fluctuations without undue lag.

Some of the common types of temperature measuring devices will now be considered separately.

Mercury, Alcohol, etc., in Glass Thermometers

These are cheap, simple, easily portable, and do not require any additional apparatus. On the other hand they can only be used where the stem readings are visible and there is a relatively high heat capacity leading to an appreciable time lag. It is possible, incidentally, to obtain bent or curved thermometers to clear an obstacle (as a special order).

Mercury in Steel, Alcohol, etc., in Metal Thermometers

These are more robust than the types previously considered, but less accurate and have a higher heat capacity. Normally, the change in volume of a liquid in a metal "bulb" due to the temperature change, is indicated on a Bourdon tube type gauge. There may be an error due to the connecting tubing if the dial is at a distance from the "bulb." Another type of thermometer uses an insert gas instead of a liquid, and in this case, the Bourdon gauge functions as a true pressure measuring device and not as a volume measure. There is a possibility of barometric error.

Metal Rod Type Thermometers

The expansion of a rod when heated operates a pointer *via* a suitable magnifying movement.

Bimetallic Strip

Two thin strips of two materials with different coefficients of thermal expansion are fixed together along their length so that the composite strip assumes a radius on change of temperature dependent on the magnitude of the change. This is sometimes used like a Bourdon type pressure gauge and sometimes as a thermal switch (automatic fire alarms, sprinklers, etc.).

Thermocouple

A thermocouple is a junction of two dissimilar conductors (metals, alloys or non-metals), often consisting of two wires fused together at one end. If the temperature of the junction varies from that of the other ends, a very small electromotive force is generated which may be measured and thus give an indication of temperature. The essentials for thermocouple materials are :—

(*a*) Must not melt or change in composition in the temperature range required.

(*b*) Must not be affected by the hot body.

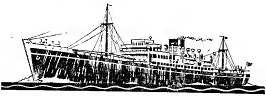
In practice, a combination of materials giving a large e.m.f. is chosen, a common pair being copper-constantan, which is suitable up to 400 deg. C., while chrome-constantan may be used up to 700 deg. C.

An advantage of thermocouples is that they can be used for high temperatures, also that the testing body may approximate to a point and is thus sometimes the only possible method for some test work. There may be an error due to conduction along the wire (reduced by the use of fine wire).

Electrical Resistance Thermometers

These measure the change in the electrical resistance of a coil of wire due to the temperature

(*Continued on page* 321)



*The 36 in. model *cargo-passenger liner* "PENANG"*

by L. W. Sharpe

HAVING bent and cut all frames to shape and approximate height, bend the stem and fit the stern frame. Mark the centre line, frame positions and recesses on second plank, file the frame slots in keel and set the keel bar up on wood blocks for support (see Fig. 19). A midship frame is now soldered in position, and all other frames from bow to stern. When all are complete, turn the whole ensemble over and solder beams as well. To test for fore and aft alignment, scribe an accurate centre-line on each beam, stretch a thin wire from stem to stern on dead centre-line and proceed to set beams in position.

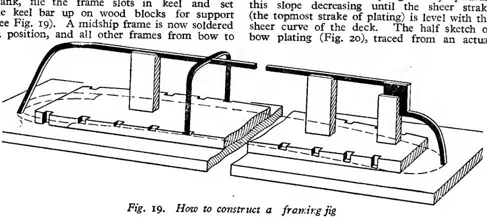


Fig. 19. How to construct a framing jig

This is done by lightly soldering brass strips across top of the beams until the hull is plated. A strip across the frames inside bottom at the bilge lines will help to keep frames at correct distance and can be left in the hull permanently. When plating is completed, angle strip is soldered at the hatch positions, and the unwanted portion of the beams cut away.

The best way to make sure your plating will fit is to cut trial dummies in thin cardboard before you get to work on sheet metal. Tracing paper will also come in useful for gauging the amount of overlap required for soldering, unless you decide to butt solder all joints. In cutting the plating strakes it is important to remember that the cross sectional area of a vessel decreases towards the ends, and so the widths of the plates must be narrowed by gradual tapering. The effect of this reduction at the ends is the reason why, on a prototype vessel, the plating is only parallel with the waterline for about two-thirds of the length.

At bow and stern it slopes gradually upwards, this slope decreasing until the sheer strake (the topmost strake of plating) is level with the sheer curve of the deck. The half sketch of bow plating (Fig. 20), traced from an actual photograph of a liner in dry dock, will explain how it is done. The double line represents the red boot-topping. If it is found that the plates are going to be ridiculously narrow at the ends, particularly at the stern, take a leaf out of the shipbuilders' book and run one or more pairs of plates into one. The latter is called a *stealer plate* (see Fig. 17), and is quite commonly used. A flexible steel rule is an invaluable asset for plating operations, because it enables a rounded surface to be measured very accurately.

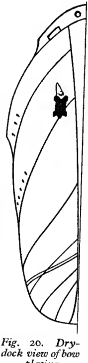


Fig. 20. Dry-dock view of bow plating

As a point of interest readers may like to know how this job of plating is done in a shipyard. A *half block model* is made in wood to scale of $\frac{1}{4}$ in. per foot, on which are marked all frame lines, decks, bulkheads, gunports, etc. It is then possible to draw in the plate edges, arrange the butts clear of obstructions, and compile a list of plates to be ordered from the steel manufacturers. The shipyard method of numbering strakes and plates is also useful to the model maker, and will save many a headache when quite a pile have to be sorted out for soldering in position. Strakes are distinguished by letters from the keel outwards, the garboard strakes (those next the keel on either side) start with "A" and most yards number plates from aft.

*Continued from page 294, "M.E.," September 11, 1947.

Thus plate 4E.S. would be the fourth plate from the sternpost in the fifth strake on starboard side.

I assume that most model builders will be satisfied to make their strakes as long as happens to be convenient, particularly as in a model the butts must be soldered at the frames, and not, as in the real thing, between them. Shorter (Fig. 21), gives an idea of proportion, and one or two other useful details. The short length of plating at the top of the stem is the apron, and besides the openings for the roller fairleads, has either one central, or more usually, two circular "eyes" for the towing and mooring wires. The curved plates from one deck level to another are the fashion plates, and there are

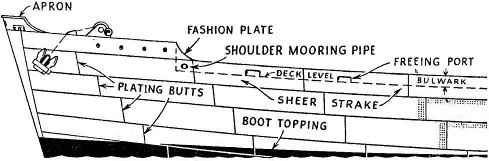


Fig. 21. Approximate shift of butts in shell plating

strakes are necessary at the ends, and there it may be possible to display some knowledge of the arrangement of joins in adjacent strakes, which is called the *shift of butts*. In a big vessel these are arranged, not as bricks are laid in a wall, but so that no two butts come vertically under each other, or at least not closer than about five strakes. In the midship cross sectional area of *Penang*, strakes 1 in. in width are suggested, because this figure allows the rounded bilge to come nicely in one strake, which saves a deal of awkward shaping, at least as far as the rectangular length is concerned.

The illustration of butts in shell plating at least four sets of mooring pipes (oval openings) with heavy rounded flanges in every big vessel. For positions of these see the general arrangement drawing. Freeing ports also figure in all weather deck bulwarks, the number depending on the length of the bulwark. The sheer strake in a prototype vessel extends 9 in. above the deck, the bulwark plating being riveted and angled to it, but for model purposes the sheer strake will include the bulwark. An angle plate or special moulding is generally fitted to all bulwark tops, and a thin wire, soldered outboard, will improve a model's appearance greatly.

(To be continued)

Temperature Measurement

(*Continued from page* 319)

change. A disadvantage is that a source of low tension current is necessary. Both this and the thermocouple method are useful where a number of test points are involved, and it is desirable to group all the readings in a central position. In practice, they both involve the use of fairly complicated apparatus and a text-book should be consulted for full information.

Change in State of the Testing Body

These types are useful for furnace or kiln work. There are several varieties as follows :—

(*a*) Holcroft Thermoscope Bars. A set of bars are supported at end. When heated, some bend, the temperature being indicated by the bar which is just beginning to sag.

(*b*) Seger Cones. These are slender pyramids which soften and tilt at various temperatures.

(*c*) Watkin Heat Recorders. These are a series of pellets placed in little depressions on a metal sheet (similar to the housewife's "patty" tin for cooking cakes). When heated, some melt, while others are unaffected, the temperature being indicated by the one which just fluxes across the top surface.

(*d*) Temperature Indicating Paints. These paints change colour on being heated, either permanently or temporarily. It is preferable to apply them in strips, rather than patches, so as not to affect any heat dissipation properties of the surface in question. A disadvantage is the small temperature range covered. For further information, the reader may care to refer to "Temperature, its Measurement and Control in Science and Industry," published by the Reinhold Publishing Co. of New York, for the American Physical Society. This book runs to over 1,300 pages!

"L.B.S.C."

INJECTOR FOR "JULIET"

AS promised in the last instalment, here are details of how to fit an injector to "Juliet." The piping arrangement is very simple; the steam-valve can be fitted to the top of the wrapper, between the water-gauge and the column of the whistle turret, whilst delivery can be made to a clackbox placed on the extreme right of the backhead, at boiler-centre level. Whilst cold feeds, except from an emergency hand-pump, should not be introduced at the back end, but always either at the smokebox end or *via* a top-feed it doesn't matter about an injector feed going in at the back. The fact of the steam having to condense in cold water to make the injector operate, warms up the resulting stream of feed-water, so that there is no undue cooling of the plates of the firebox in the vicinity of the ingoing water. Incidentally, I found that the delivery of a small exhaust injector with supplementary live steam cone was so hot that it partly flashed into steam at the overflow gap, and a valve had to be placed on the pipe. It is a pity the grease separation presents such a problem, but I have hopes of overcoming it in due course.

Steam Valve

Make up another flange fitting, the same as the one supporting the upper fitting of the water-gauge, and mount it in exactly the same way, over a 5/32-in. hole, between the water-gauge and the stem of the turret fitting. This carries a screw-down valve of the same type as specified for the blower; and if you'll be kind enough to look up the instructions for making that component, it will save a repetition of the ritual. When it is screwed right home, the union nipple should not hang straight down, but be inclined slightly to the left, toward the gauge-glass. Many full-sized injector steam-valves have cross handles instead of wheels, like the handles of the domestic bathroom taps; and a small handle of this sort may, of course, be used in place of the wheel, especially by those good folk who don't possess "asbestos fingers." A pin screwed into the rim of the wheel, *à la* L.M.S. practice, is handy when the driver's fingers are greasy, and liable to slip on a plain rim, even when heavily knurled.

Water Valve and Clack-Box

The water-valve is similar to the by-pass valve already dealt with, the only difference being that the valve pin is extended to a length of approximately $3\frac{1}{2}$ in.; and instead of a wheel, the handle is made like that of a tender hand-brake. Screw or drive a $\frac{1}{4}$-in. length of $\frac{1}{4}$-in. round steel on to the upper end; drill a No. 49 cross-hole through the lot, and squeeze in a short piece of 15-gauge spoke wire, bending up the end as shown. If you have only $\frac{1}{16}$-in. or 3/32-in. wire (16 and 13 gauges) you can use either, drilling No. 53 and 43 respectively.

To mount the valve, drill a $\frac{1}{4}$-in. hole near the back end of the tank, about $\frac{3}{16}$ in. above the top of frame, so that the valve will clear the frame when the tank is in place. You can, if you feel energetic enough, fit the valve close to the bottom of the tank, but, in that case, a clearance will have to be filed in the frame to accommodate it, and personally I don't think it is worth the trouble. True, you can't drain the tank right out when using the injector with the valve some distance above the bottom of the tank; but by the time the water gets that low it will also be fairly hot, due to the proximity of the boiler, and injectors won't work when the water is too hot to condense the steam, so you'd have to fill up anyway. A small sheet-metal bracket or bearing, made from 16-gauge brass, with a No. 21 hole drilled in it to take the valve-spindle, is attached to the tank near the top, to steady the spindle. The screw holding it is nutted inside the tank. I shouldn't be at all surprised to get one or two letters asking how the spindle can be put through the hole in the bracket with the handle in place. Judging from some of the correspondence received, some of the writers wouldn't think of taking the spindle right out of the valve, and pushing it through the hole in the bracket!

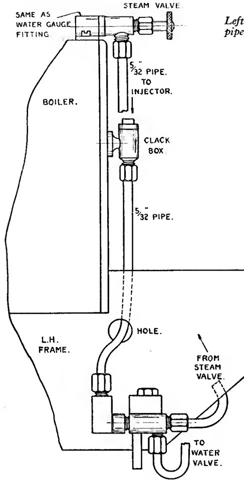
The clack-box is exactly the same as those described for fitting on the boiler barrel. At the level of the centre-line of the boiler, on the extreme right-hand side of the backhead, drill a 7/32-in. hole and tap it $\frac{1}{4}$ in. by 40. Screw the clack-box straight in. As the backhead is thick enough to take sufficient thread for a firm hold, no sweating-in is necessary; just put a smear of plumber's jointing on the threads and be sure the clack-box is vertical when screwed right home. About an inch below the top of the left-hand frame, and just behind the backhead, drill a hole big enough to allow a $\frac{5}{16}$-in. hexagon union-nut to go through; make a $\frac{1}{8}$-in. pilot hole first, and enlarge it to, say, 13/32 in. This is to let the delivery pipe pass through.

How to Erect the Injector

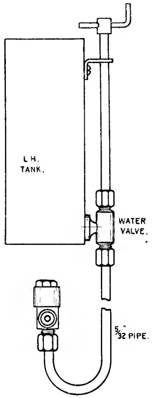
The injector, as previously mentioned, is made the same as "Lassie's" except that the water inlet nipple is placed at the bottom instead of at the side. Hold it in the position shown in the illustration, near the rear-end of frame, and about $\frac{1}{2}$ in. away from it; and with a bit of soft wire (I use thick lead fuse-wire) take the distance from the bottom of the water valve, to the water nipple on the injector, bending the wire to a swan-neck upside down, as shown. If the wire is straightened out, and the piece of 5/32-in. copper tube cut to same length, you won't waste

any. Fit a union-nut and cone to each end of the pipe, bend same to the shape shown in the illustration, and couple up. This pipe will then hold the injector in position whilst you measure up for the other pipes, the *modus operandi* being exactly as described above. Both steam- and water-pipes are 5/32 in. diameter; the steam-pipe should pass straight down, as near the backhead as possible, close to the water-gauge, and when below footplate level, proceed in a nice sweeping curve, around to the steam end of the injector. The delivery pipe should take a bend to pass through the hole in the frame, then proceed across under the footplate, and curve upwards to connect up to the union under the clack-box. Try and keep your pipe-work as neat as you possibly can, especially where it shows; and, most important of all, avoid any kinks in the delivery-pipe. A sharp bend doesn't matter, provided that the water has plenty of room to move; for instance, on a full-sized Gresham and Craven combination injector, such as we had on the Brighton engines, the water has to go around sharp corners and reverse its direction completely. Yet any restriction in the size of the delivery pipe, caused by scale or "fur," cattled them up at once, and same applies to a kink in the delivery pipe of a small injector.

The pipes provide sufficient support for the little bit of squirting apparatus, which weighs about an ounce, and no other fixing is needed. The complete injector can be removed for cleaning, in a matter of seconds only, by unscrewing the three union-nuts, steam, water, and delivery. Operation, too, is a simple matter; turn on the water-valve, and when water starts to run from the overflow pipe, open the steam-valve fully. The injector, if properly made, will immediately "pick up," as the enginemen say, and start feeding. If the overflow continues to dribble, close the water valve gradually until it leaves off. When working "dry," the jigger makes a noise like the chirping of a linnet. If, after a time, the overflow persists in dribbling, and blows steam badly if an attempt is made to regulate the water supply, it is a sign that the



Left—How to connect injector steam and delivery pipes. Below—Water valve and pipe (end view



cones are becoming furred up. Those on my own engines run for months without any attention, the water in our locality being about the purest mains water to be found in the whole country; but in the neighbouring district, it is so bad that domestic kettles need washing out every week or so, to get rid of "fur." When living at Norbury, I had to wash out old "Ayesha's" boiler after about 20 hours' steaming and got plenty out of it at that; whilst the domestic hot water system failed so often, that we discontinued using it. The last time I took any pipes down, the $\frac{3}{8}$-in. feed pipe was furred up to the size of a blacklead pencil! I believe things are better around there now, as the Metropolitan Water Board took over, after the typhoid scare. Anyway, if you find the little injector cones showing any traces of sediment or deposit from the water, soak them in a solution of weak muriatic acid (spirits of salts) one part of acid to ten of water. This is the same strength of solution advocated by the firm mentioned above for cleaning full-sized cones. It will also fetch out all the scale, lime, chalk and other undesirable stuff from the boiler of a little locomotive, without injuring the metal; but no locomotive builder should ever let his boilers get into such a state that they need acid treatment. During the holiday week, I saw a poor old Maunsell 2-6-0 of class "N," go perambulating by, valiantly plodding up the 1 in 264 with a fifty-wagon load; but goodness only knows the last time she had received a boiler wash, for the chimney, smokebox, and best part of the boiler were covered by white streaks, as if some kiddy had been busy with a whitewash brush. The dirty boiler had, of course, caused excessive priming, and the stuff thrown out of the chimney had just dried on where it fell.

Running Hints—Coal and Oil

Many of the readers of these notes are building "Juliet" as an initiation into our fraternity, and have asked for a few hints on driving, and management in general. Well, there's nothing much to learn in operating a little locomotive; as in full-size practice, the most important things to aim at, are keeping up steam pressure and water level. A good test for an amateur engine-driver—incidentally, for the engine as well—is to start on a continuous track with low steam, and not much water showing in the glass, and build up both steam pressure and water level whilst running; I have demonstrated this many a time, and often laugh to think of the pre-Live-Steam days, when locomotive owners never thought of starting until they had full pressure, and thought no end of the engine if it managed to do a few laps running light, without loss of pressure. Very few of them did, as a matter of fact!

Two essentials to effortless running are, good coal, and good oil for the cylinders and valves. I get best results with a mixture of Welsh steam coal, and anthracite mixed; the Welsh lights up quickly, and the anthracite gives "body" to the fire, being long-lasting. For an engine with a firebox the size of "Juliet's" it should be broken up to the size of large peas or small beans, and have all the dust sifted out. Coke can be used, also "Coalite," and other patent smokeless fuels; but some of them leave a green deposit on the firebox plates. The grade of house coal doled out to unfortunate householders at present, is useless for locomotives purposes; you might just as well try to get steam out of tarmac and granite chips. Anthracite peas as used for "Esse" and "Salamander" stoves, make plenty of steam, but they need a strong blast. "Phurnod" varies; some is excellent, making bags of steam and leaving little ash and no clinker; other grades cake badly and the fire burns hollow and falls to pieces.

As to cylinder oil, I have often heard it stated that oil as used for automobile engines, seeing that it stands up to internal combustion, is all right for superheated steam. Don't you believe it! The oil in a car engine is either pumped or splashed over the whole of the moving parts, in such a quantity that they are continuously "washed" by the spray, and the oil doesn't need any "clinging" properties. In small cylinders—and in full-sized locomotives too, if it comes to that—conditions are vastly different. What is required here, is an oil that will cling to the cylinder walls, port faces, valves and pistons, and form a tenacious film that not only acts as a lubricant, but forms a steam seal. Exactly the same kind of oil that does the job on big sister, will do it on the little one. At the present moment I am using a brand called "Cyltal 80 S," which is a thick black commodity like old-fashioned gear oil and is so economical that I am having to line up all my $\frac{1}{8}$-in. bore lubricators to 3/32 in. to prevent oil spray being thrown out of the engines' chimneys. Cylinder oil for use with superheated steam, sold by the Vacuum Oil Co. (Vacuum 600 W) Wakefield's, Price's, and other well-known oil specialists, are all O.K. for small non-ferrous cylinders. For axleboxes, valve-gears, coupling-rod pins and other moving parts, I use the Vacuum Co.'s "Etna Heavy Medium" (this is also used for my workshop machinery); but any good brand of machine oil will do quite well. I use small force-feed oilers both for filling mechanical lubricators and "iling the jints," as one of my old fellow-conspirators used to say. One has a long piece of $\frac{1}{8}$-in. copper pipe soldered into the spout, so that it is possible to oil everything underneath without turning the locomotive upside-down.

Auxiliary Blowers

The simplest auxiliary blower for a beginner is a piece of tube from 6 in. to 8 in. long, fitting the locomotive chimney, with a blower jet near the bottom, made from a bit of $\frac{1}{8}$-in. pipe contracted at the end, formed into a bend, and silver-soldered into a hole in the side of the chimney tube, so that the jet from the end of the bent tube blows straight up it. The blower tube is supplied with compressed air from a tin can, which is kept charged by being connected to a tyre pump; or it may be steam-operated from a boiler on a Primus stove or any other convenient form of heating. Unless a special cock is fitted for the purpose, you can't blow air into "Juliet's" boiler with a tyre pump and use her own blower. Various forms of power-driven blowers have been illustrated and described in

these notes, of both the blowing and suction variety; one of the latter, made by Mr. Honeyfield, of the Sutton Club, is shown getting up steam on Mr. Blackman's $2\frac{1}{2}$-in. gauge "Annie Boddie."

Operating "Juliet"

Fill the boiler through the safety-valve bush until the glass is a little over half full. Oil every moving part with machine oil, and fill the cylinder lubricator with cylinder oil of "superheater grade." Put the auxiliary blower in position. To start the fire, either use charcoal in knobs about the size of filbert nuts, or small wood chips. Put some in a tin lid, wet them with paraffin, shovel enough into the firebox to cover the bars, start the blower going (get somebody to pump for you, if using a tyre pump) and throw a lighted match into the firebox. As soon as the fuel catches alight all over, throw in some more; wait until the whole lot glows red before adding coal. There should be enough steam to work the engine's own blower in about four minutes, when the auxiliary can be dispensed with. As soon as about 50 lb. shows on the gauge, put the engine in forward gear, and open the regulator a little. The steam, going into the cold cylinders, will condense, and the water may form a lock between piston and cover; give her a helping hand to clear it, but keep clear of the chimney. As soon as she has got rid of the condensate water, and the cylinders are hot, she will try to scoot off, so mind she doesn't get away and wreck herself. You can now couple on the flat car, take your seat, open the regulator, and proceed to enjoy a real thrill!

Warning—take it a bit steady until you get used to the job; new beginners are usually so excited at being hauled by their first attempt, that they are apt to "go a bit loopy" and upset the whole apple-cart. It's excusable!! Anyway, once you are well away, the little tank engine will do her best to emulate the "Coronation Scot" or some other crack full-size train; the fact that she only has four little wheels to do it with, won't worry her in the least, as she will spin them to such good purpose that main-line speed is easily maintained. Look well after the fire and water; she will soon begin to blow off, and that is the right time to put more coal on the fire. Never wait until the fire gets low before using the shovel, otherwise the steam pressure will fall before the fresh coal catches alight.

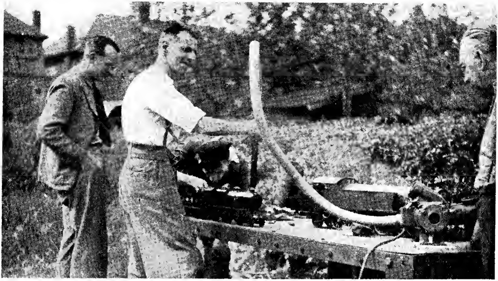
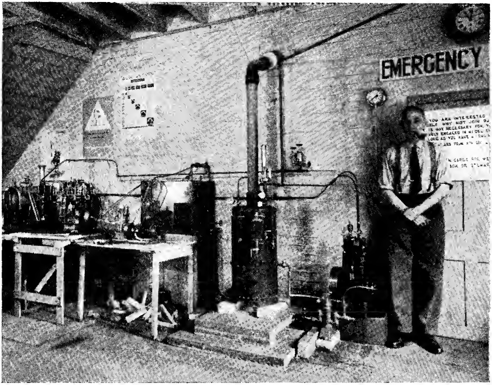


Photo by] *Getting up steam with a "suction fan"* [*C. J. Grose*

Have the pump by-pass open when starting, and take a look through the flap cover to see that water is squirting from the stem of the valve, an indication that the pump is working properly. As soon as the water drops below half a glass, close the by-pass valve. If the water rises rapidly, open the valve a little; it only requires practice to regulate the by-pass so that the water keeps fairly level all the time, about $\frac{3}{4}$ of a glass. If you want to operate the injector on the run, as on a full-sized engine, do so when there is a good fire, and she is either blowing off or just going to. Don't put the injector on with a dull fire and low steam. "Juliet's" boiler, properly fired, will be "boss of the cylinders" under any conditions of working; if she persists in blowing off all the time, open the firehole door a little. Keep up a decent fire, keep up your water level, and "Juliet" will "keep on keeping on until the cows come home!"

When through, let the fire die down, dump the residue by pulling out the ashpan pin, and thoroughly clean off any ash and grit that may have fallen on the eccentrics and axleboxes—*very* important that!—then wipe down the boiler, tanks, etc. with a soft rag or some waste. Never be tempted to put the engine away dirty.

Working Exhibits at Exeter



The vertical boiler erected by Mr. Harding for running models under steam at the Exeter ' *Society's exhibition*

A VERY successful exhibition was held by the Exeter and District Model Engineers' Society, in the Police Gymnasium, Exeter, from July 14th to 19th, 1947. President Mr. Harding erected a vertical boiler in a spot previously occupied by a "Tortoise" stove, and many models were working under steam. It was considered that the exhibition was far more interesting than it would have been if the more usual compressed air had been used. Among the models working under steam was a traction engine and threshing set, constructed by Mr. Balkwell, and this ran throughout the week trouble free. Mr. Eves-Down's scale model of an Aveling and Porter compound traction engine was also seen under steam, and the fine workmanship in this model was much admired. Two horizontal mill engines were working under steam, as was also another outstanding exhibit, a compound condensing marine engine exhibited by Mr. T. Spike.

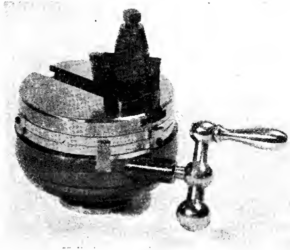
Other models shown were a Union Castle Line *Stirling Castle,* exhibited with other ship models by Mr. Hiscocks. This vessel had lights burning, the current being supplied by a high-speed steam generating set exhibited by Mr. Harding. Locomotives and rolling stock in all gauges were on view, and the total number of models exhibited was 174. Plymouth, Barnstaple and Taunton Societies kindly loaned exhibits, and four local firms had trade stands.

The exhibition was run in conjunction with the Exeter Accident Prevention Council's Accident Prevention Week, and in this connection it was a great success, 5,000 people visiting the show and at least 80 per cent. of these afterwards visited the Police Traffic Demonstration Room where various forms of propaganda were on view.

As a result of the exhibition the Princess Elizabeth Orthopaedic Hospital benefited by about £70. The Exeter society are constructing a multi-gauge passenger-carrying track in the grounds of this hospital so naturally they take a great interest in its welfare. The Club's funds will also benefit to the extent of about £70.

Spherical Turning

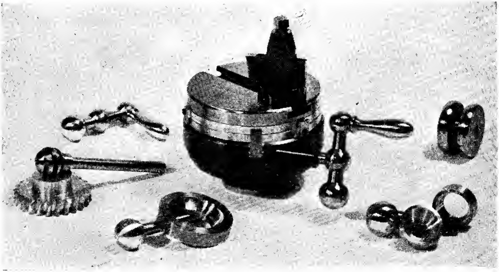
A PROBLEM which frequently arises in lathe work is the turning of a sphere or spherical arc, and in cases where a high degree of accuracy is necessary, this may prove to be a difficult task unless special appliances are available. Various methods are employed in practice for turning spherical curves. In the past, billiard balls and similar classes of work have been produced on simple lathes, and with hand turning tools only; but while it is claimed that the results obtained in this way are very accurate, the exact limits of error are rarely subjected to close scrutiny or measurement. It will be clear that accuracy depends more on skill of hand and eye, than upon the soundness of the method, as there is no positive control of the size or shape produced; and from the aspect of commercial production, it is a slow and uncertain method.



The Trumek spherical turning tool, with spigot base to fit the South Bend lathe

Spherical curves are often produced in commercial practice by means of forming tools, and this method is generally satisfactory for working to moderate limits, besides being the quickest method for quantity production. But several practical problems arise in attaining and maintaining a high general quality of work by this method. The tools used are comparatively expensive and difficult to maintain in good cutting condition; the mandrel bearings of the lathe are subjected to heavy stress by the broad forming cut, and it is sometimes difficult to support the work really adequately to avoid spring. Chattering and scoring of the work surface are liable to occur, with disastrous effects to the quality of finish and accuracy.

In light lathes, it is generally impracticable to use the forming method for any but very small spherical curves,

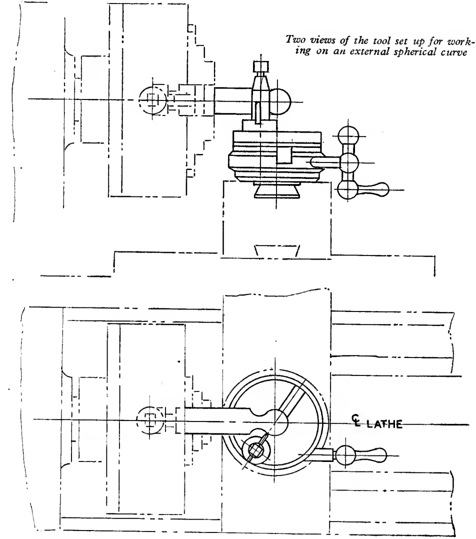


Components of the Trumek spherical turning tool

because forming tools of any great breadth impose too heavy a strain on the bearings and slides. Some success, however, has been obtained with tangential forming tools with an oblique cutting edge, applied either over or under the work with horizontal traverse, so that the edge comes progressively into action and does not cut over its full width all at once.

and over any required angular range of movement. Only the ordinary type of cutting tool, with no specially formed edges, is required, and within certain limits, the same tool may be used to turn either inside of outside spherical curves.

The equipment required for spherical turning consists essentially of a tool holder attached to a table or arm which is capable of partial or com-



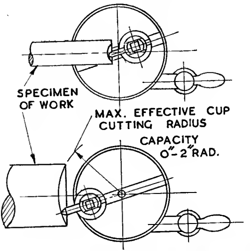
Two views of the tool set up for working on an external spherical curve

There is no doubt, however, that both in respect of accuracy and range of application, the best method of turning spherical curves is to provide a means of traversing the tool point in an arc of the required radius, at right-angles to the running axis of the work. This has the primary advantage of being a true generating process, and a further practical advantage is that the tool may be adjusted to work at any required radius,

plete rotation about a central pivot, and provided with means of adjusting the radius of the tool point. Some device for swinging or "traversing" the tool must also be provided; this may consist in some cases of a simple lever, but better control of the tool is obtained by a more controllable movement such as a worm-gear. The entire rotating assembly must be rigidly mounted on a suitable fixture on the lathe

bed or slide-rest, and is most conveniently arranged to pivot around a vertical axis, though it is practicable to arrange for rotation about a horizontal or oblique axis if necessary.

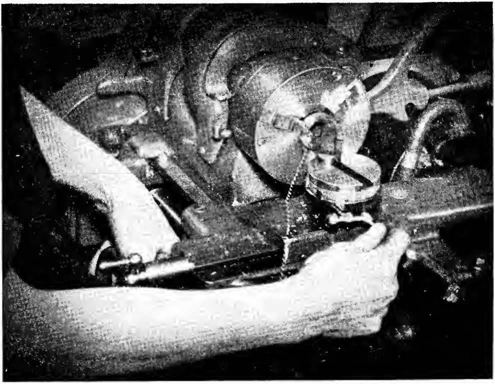
Appliances working on this principle have been manufactured as standard or special items of equipment for certain types of lathes, but so far as can be ascertained, their universal application to ordinary lathes has not been envisaged, or at any rate, suitable attachments have not hitherto been available. Recently, a firm of engineers, finding the necessity for a spherical turning tool for dealing with their own production problems, has evolved a compact attachment for this purpose, which is applicable to practically any type of lathe from $3\frac{1}{2}$ in. to 6 in. centres,



Showing maximum and minimum internal radii which can be machined by the tool

and capable of dealing with a wide range of spherical radii, both internal and external, to cover most requirements likely to be encountered in model, instrument and light engineering practice.

We have examined and tested this attachment, which consists of a circular steel baseplate, equipped with either a spigot or a flange suitable for mounting on the cross slide of the lathe, and carrying a small circular rotating table, with a large diameter spigot which takes a bearing in the bore of the baseplate. To the underside of the spigot is attached a bronze worm-wheel, working in a clearance recess in the baseplate, and shims or other means of adjustment are provided to take up end play in the spigot bearing, and thus eliminate all possi-



The Trumek tool in use on an internal radius

bility of rocking the turntable. A steel worm engages the worm-wheel, its shaft being housed in a tangent bush projecting from the side of the baseplate, and provided with a ball handle.

The turntable is provided with a tee-slot passing diametrically across its top surface, to provide a means of mounting the tool post, which is of the lantern type, so that the tightening of the single set-screw both secures the tool bit and locks the tool post in position.

A circular groove on the outside edge of the turntable is provided to hold adjustable segmental stops, which serve to limit angular travel when required, by abutting against a fixed stop-piece on the baseplate. For the purposes of centralising the attachment, a true hole is bored in the centre of the turntable, to take a centre-point or setting mandrel.

In a variation of this appliance, means are provided for mounting it with the axis horizontal, by equipping it with a square stalk which can be held in the normal tool-post of the lathe, but for most purposes, the standard baseplate fitting will be found best in respect of rigidity and also enable the cutting edge of the tool to be seen better.

To centralise the attachment, a point centre long enough to reach up to the height of the lathe centre, so as to be matched against it, may be used; or the standard mandrel may be used, in conjunction with an eccentric locating pin (such as the driving pin in the lathe catchplate) by taking measurements with the pin at the front and back centre positions in turn. When thus adjusted, the index position of the cross slide should be noted, or a stop fixed to limit its travel, so that the main removal of metal from the work may be carried out by feeding in the cross slide, and reaching the set position for the final cut.

Unless the axis of the turntable is properly adjusted, a true sphere cannot be produced; the work will be barrel-shaped or oblate. It is also most essential that the tool point should be set exactly at centre height, or errors of a similar nature, though possibly smaller in magnitude, and thus more easily overlooked on casual inspection, may be introduced.

The rotary movement of the turntable may be utilised for other purposes than spherical turning; for instance, it may be used as a rotary milling table to facilitate various circular milling operations, either on the lathe cross slide or the vertical slide. It could also be used for indexing, and in this respect, it may be noted that graduation of the turntable in degrees would be useful, and is under consideration by the makers.

This appliance is manufactured by Trumek Ltd., 193, London Road, Kingston-on-Thames, to whom all communications respecting it should be addressed.

Curing Porous Ponds

by F. E. Markham

I CAN recommend the following procedure to Mr. J. A. Brocklebank and others whose ponds are porous. Completely empty the pond, and with a wire brush or scrubbing brush and numerous buckets of water, or the hose if you prefer it, cleanse the surface of the existing concrete. If the pond has been filled for some time the pores of the concrete will probably be filled to some extent with vegetable matter, and it is necessary to remove as much of this as is possible.

When the pond is considered to be clean, remove the cleansing water, and finish off by rubbing down with an old clean cloth. Next, procure some Pudlo cement waterproofer, obtainable from almost any supplier of builders' materials, also some cement, and some washed sand which should be fairly sharp. Pit sand would be satisfactory and, if not washed at the pits, place some in a bucket to a depth of a few inches, add water, stir vigorously with a stick, and immediately pour the water off. The sand will sink to the bottom of the bucket leaving the loam in the water. Repeat this three or four times.

Add 4 per cent. by weight of Pudlo to the cement, and to this add three volumes of sand, *not more.* See that the Pudlo and the cement are thoroughly mixed. The amount of Pudlo used need only be closely approximate, or, in other words, make a good guess at it! Now add water as in the case of ordinary concrete-mixing, taking care that the mixture does not get too sloppy.

Mix some cement with water to the consistency of whitewash, and with an old brush apply a liberal coating to the pond. Follow up immediately with a coating of your concrete to a thickness of about one inch, trowelling it hard against the sides of the pond. I found it best to get into the pond and cover the bottom first, building up the sides and leaving a way of retreat. The trowelled work can be smoothed over with an old wet brush, but if the surface is slightly rough so much the better. The whole procedure is very simple and takes very little time.

Do not let the work dry too quickly. If it cannot be covered completely with boards, wait until the concrete rendering has set and then cover with wet sacking. Keep the sacking wet for about a week. I find that the vegetable growth will form on the surface described, but will not adhere. Even a shower of rain will wash the sides of the pond clean somewhat like a great china bowl.

Whilst the pond is empty, take the opportunity of eliminating corners by filling with Pudlo concrete, so that when freezing takes place the ice can "ride" up and so avoid bursting the pond. The pond will be ready for use again in a week to ten days. It is most important that the Pudlo be thoroughly mixed with the cement before the sand is added. After this it is child's play.

I would add the usual disclaimer where the Pudlo is concerned, as this is merely a case of helping the other fellow out of a difficulty.

Cutting Diagonal Racks and Pinions

by "Vulcan"

FROM time to time brief descriptions have appeared in THE MODEL ENGINEER of microscopes made by amateurs. Generally in these descriptions the only components purchased from the trade have been the lenses and the diagonal rack and pinion used for the coarse focussing. It is understandable that most builders of microscopes should not attempt to grind their own lenses, for though lens grinding is generally about ¼ in. diameter and has usually 12 or 14 teeth of involute form. The length of the pinion is roughly equal to the width of the rack. It should not be less and there is really no point in making it a great deal more.

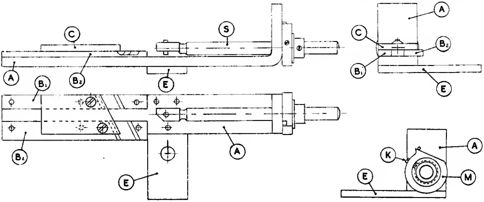


Fig. 1. Jig for cutting diagonal racks

is well within the capacity of the careful amateur it is a specialized craft and requires specialized tools and materials. This, however, is not the case with the diagonal rack and pinion. The rack is really quite a simple job for anyone with a lathe of 3½-in. or more centre height, and a vertical slide. The cutting of a spiral pinion is certainly a little more difficult, but may be tackled by any amateur who possesses a lathe.

It will no doubt interest many readers to learn that Mr. F. W. Portass, of Adept lathe and shaper fame, has built two folding compound microscopes, complete with spiral rack and pinion coarse focussing, using no other machine tools than a Super-Adept lathe and a No. 1 Adept shaper. Mr. Portass has very kindly loaned to the writer the home-made jigs, which were used in the production of these racks and pinions, and has given him permission to describe them to readers of this journal. Before doing so, however, it would perhaps be as well if the usual disclaimer was made. The writer is in no way connected with the business of Mr. Portass. It might also be mentioned that the simple jigs here described could very well be used on any lathe of which the centre height is more than 1½ in.

As most readers will be aware, the diagonal rack used in the coarse adjustment of the compound microscope is made of brass and is about ¼ in. wide and its teeth slope at an angle of between 20 and 30 degrees to the width of the rack. The exact angle is immaterial so long as the pinion and rack match each other. The pinion

The Rack

In Mr. Portass's microscopes, both this component and the pinion were cut by means of a suitably shaped fly cutter held in a cutter-bar and rotated between the centres of the Adept lathe. It was necessary to devise some means of moving the rack along the required distance between the two cuts forming each tooth. This was achieved by the use of the jig shown in Fig. 1.

The base A, consists of a length of ¾ in. × 3/16 in. B.D.M.S., with about 1 in. of one end turned up at right-angles. On to this, two pieces, B_1, and B_2, of ⅛-in. thick steel strip are riveted, leaving a space between them equal to the width of the rack. Over this again a clamping-piece, C, is fastened by means of the two countersunk screws. Under the base A a piece of ¾-in. × ⅛-in. B.D.M.S. E is riveted and by means of a hole in it is used for clamping the whole jig to the top of the saddle in place of the topslide.

The rack to be cut is placed between the two pieces B_1, B_2, and is held in place by tightening the two c/s. screws. After each cut these screws are loosened and the rack moved along by the screw S through the thickness of one tooth and one space. The screws are then tightened ready for another cut. The screw S is cut with a ¼-in. B.S.W. thread. The short length of plain rod at one end is partially cut away and a pin fixed through it, as shown. This pin engages in a hole in the end of the rack and so causes the rack and screw to move together. The screw passes through a hole in the upturned end of piece A and carries on its outer end a nut in the form of a 20-tooth 40-D.P. pinion. By rotating this nut the rack can be drawn along. The

collar shown surrounding the pinion was fitted to enable the pinion to be turned through less than a complete revolution with little risk of a mistake. Mr. Portass found that he required to move his rack each time rather less than 1/20 in., which is the pitch of a $\frac{1}{4}$-in. B.S.W. screw. The actual distance required in his case was almost 19/20ths of 1/20 in. In other words, if the 20-tooth pinion was rotated 19 teeth, the rack moved near enough to the required amount. On examining the drawing, it will be seen that a collar M surrounds the pinion, and is clamped to it by a pointed grub-screw, K. The collar, M, has a projection formed on it which is arranged to butt against a pin in the upturned end of A. To move the rack the required distance the grub-screw K is loosened and the pinion turned back just one tooth. The grub-screw is then tightened again and the whole collar given one complete turn forwards. In use the jig is clamped to the slide-rest at an angle and to the rear so that cutting takes place as the cross-slide is moved forwards towards the operator.

The Spiral Pinion

This again requires a simple jig, the base of which consists of a length of $\frac{3}{4}$-in. $\times$ $\frac{3}{16}$-in. B.D.M.S. (A), Fig. 2. Through this base two standards BB are riveted. These consist of short lengths of $\frac{3}{8}$-in. diameter steel rod with one end reduced to $\frac{1}{4}$ in. diameter, and the spigot thus formed passed through a hole in the base and riveted over. These two standards have a $\frac{1}{4}$-in. horizontal hole drilled through them at a height of $\frac{3}{8}$ in. from the base. To facilitate the drilling of these holes, one side of each standard was filed flat. A third standard, B_1, is fitted in a similar way, but has a $\frac{1}{4}$-in. tapped hole instead of a plain hole through it. Through this tapped hole a length of $\frac{1}{4}$-in. Whit. screwed rod, S, with a head, K, is screwed. This screw is used to feed the pinion against the cutter. The steel rod, R, to be formed into the pinion, is fitted through the standards, BB, and butts against the screw S.

It is usual to form the pinion in a microscope solid with its spindle in the same way as that used by watch and clockmakers. Before, therefore, attempting to cut a spiral pinion on a length of rod, one end of the rod should be reduced as shown. In the method of cutting adopted by Mr. Portass, it is necessary to leave reducing the other end of the rod until after the pinion is cut, as the $\frac{1}{4}$-in. rod is used as its own spindle.

The spiral form is given to the pinion by means of the cam C. On the steel rod, R, a drum, D, is slipped. To this a short length of $\frac{1}{2}$-in. $\times$ $\frac{1}{8}$-in. steel strip, E, is fixed. Round the drum, D, and fixed to it by two screws is wrapped the cam, C. This is carefully filed to the correct angle. The sloping face of the cam butts against a small steel stop, T, riveted into the base. The drum, D, would be quite free to rotate on R, but for the index, I, which works in a slot cut in the flat plate, E, and drops in between the teeth of the pinion, P. The pinion, P, is fixed to the rod, R. In the present case, it has 28 teeth of 40 D.P. By indexing between alternate pairs of teeth a 14-tooth pinion is cut.

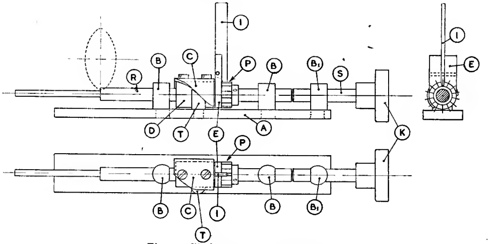


Fig. 2. Jig for cutting spiral pinions

To cut the pinion the rod, R, is fitted to the jig, and the latter is then clamped to the saddle of the lathe. Here again the feed should be against the cut, and so unless the lathe has reverse motion and means of driving the cutter bar in that direction, it is necessary to fit the jig at the rear of the saddle. The index is dropped in between two teeth of the pinion, P, and the rod, R, is then fed against the cutter by means of the screw, S. If arranged as shown, the cut will tend to force the rod, R, against the screw, S, and also the cam, C, against the stop, T. It may, however, be necessary to steady the index I, with the fingers. After one cut has been made far enough the lathe is stopped and the rod withdrawn and rotated through 1/14th of a complete turn by lifting the index, I, and dropping it into the next gap but one in the pinion, P. When all fourteen cuts are made, the pinion is finished by turning both ends to suit the job in hand.

Editor's Correspondence

The Heat Pump

DEAR SIR,—May I suggest to Mr. J. A. Brocklebank to be a little more wary in casting doubts on the heat pump.

Those installed in the Town Halls of Norwich and Zurich are functioning well. The B.E.I.A.R.A., 15, Savoy Street, W.C.2, published (1945) 4s., a Technical Report by D. V. Onslow, Ref. Y/T7, on the matter including a bibliography of 89 publications. There are a good number of these pumps installed all over the world for experiment.

The logic of his argument on "Finish" may be sound, but over-riding logic (as so often happens) is the human eye which demands that a model should "look" real including finish; super finish does not look real—it is too good.

The garden lily pond may be treated with "Snowcem" or bitumen paint; but cracking may cause leakage. Remedy: reinforced concrete.

Yours faithfully,
Cambridge. ALFRED J. WINSHIP.

Hunting Traction Engines

DEAR SIR,—I read with interest the article in THE MODEL ENGINEER of July 1st, by Mr. W. Boddy, on his attempts to secure photographs of traction engines. Your contributor may be interested to learn that there are many engines at regular work in Essex.

I have, in the course of my work, to inspect and report upon the conditions of the boilers of these engines, and have, under my supervision Burrell engines of single, compound and single-crank compound types, ranging from the 8 h.p. single, to the large compound showmen's engines. There are also many engines by Ransomes Sims & Jefferies, of Ipswich, Clayton & Shuttleworth, of Lincoln, and a few by Garrett, of Leiston, Aveling & Porter, of Rochester, and Wallis & Steevens, of Basingstoke. I should say, without going through my papers, that I have about forty to fifty traction engines, and five or six sets of the fine old Fowler steam ploughs, which I have to inspect once a year.

It seems a great pity that these fine old jobs should be forced out of use now by shortage of coal, as there is nothing to touch them for reliability and capability.

Since the more general use of electric welding has come into effect, it has been possible to deal with firebox repairs, very efficiently, and the old unsatisfactory methods of chain stitching cracks, and fitting patches with screwed rivets, has been superseded.

There are many of these engines which are forty years old, and are still in good order, and I hope it will be many years before we see the last of them, and nothing would give me more pleasure than to see their manufacture renewed.

Yours faithfully,
Wivenhoe. H. V. WADLEY.

A Machining Problem

DEAR SIR,—In the course of preparing the specimens required on one of our research projects here at the Pennsylvania State College, we have encountered an extremely vexing machining problem which we have not been able to solve in a satisfactory manner. From many years of reading your journal I am well familiar with the mechanical ingenuity of your readers and would appreciate the opportunity of laying our problem before them with the hope that someone may be able to help us, and thus assist in carrying forward an important bit of scientific research.

The problem is this: specimens of hot-rolled, low carbon steel 0.4 in. thick are to be pierced with holes 0.0785 in. in diameter; the holes to be drilled, reamed and lapped to a high finish with no "bell-mouthing" and with a minimum surface distortion or cold-working of the steel within the hole. The drilling and reaming are, of course, simple operations, but we have had difficulty with the lapping operation, and it is on this that we would like to have assistance. The length of the hole in conjunction with its small diameter make it difficult to devise an expanding lap which will do the job properly. I have had some success by preparing a series of pieces of drill-rod plated with copper to gradually increasing diameters. A number of these were then used successively with suitable lapping compounds to achieve fair results. A great deal of time and care are required to make a set of laps in this way and they are difficult to use since the laps frequently seize in the holes (due probably to their lack of resiliency) and ruin the specimen. Furthermore, the laps have a very short life. Since there are several hundred specimens to be prepared and several dollars worth of machining must be done on each before making the hole, our reluctance to use a method both slow and likely to result in spoiled work can be appreciated.

Anticipating that someone familiar with electropolishing methods may suggest the use of this technique, I may point out that we have polished holes *via* electropolishing with fair success. For a variety of reasons which would require too much space to discuss here, we are dissatisfied with these holes and hope, if possible, to accomplish the finishing operation by mechanical lapping.

Any and all suggestions as to a way out of our difficulties will be gratefully received.

State College, Yours faithfully,
Pennsylvania. HAROLD J. READ.